CLAIMS

What is Claimed is:

1. A device for transdermally delivering a biologically active agent, comprising:

a member having a plurality of stratum corneum-piercing microprotrusions; and

a coating disposed on said member, said coating including a biologically active agent and a vasoconstrictor.

2. The device of Claim 1, wherein said biologically active agent comprises a vaccine selected from the group consisting of conventional vaccines, recombinant protein vaccines, DNA vaccines and therapeutic cancer vaccines.

3. The device of Claim 1, wherein said biologically active agent is selected from the group consisting of ACTH (1-24), calcitonin, desmopressin, LHRH, LHRH analogs, goserelin, leuprolide, parathyroid hormone (PTH), vasopressin, deamino [Val4, D-Arg8] arginine vasopressin, buserlin, triptorelin, interferon alpha, interferon beta, interferon gamma, FSH, EPO, GM-CSF, G-CSF, IL-10, glucagon, growth hormone releasing factor (GRF) and analogs of these agents, including pharmaceutically acceptable salts thereof, and mixtures thereof.

4. The device of Claim 1, wherein said vasoconstrictor is selected from the group consisting of amidephrine, cafaminol, cyclopentamine, deoxyepinephrine, epinephrine, felypressin, indanazoline, metizoline, midodrine, naphazoline, nordefrin, octodrine, orinpressin, oxymethazoline, phenylephrine, phenylethanolamine, phenylpropanolamine, propylhexedrine, pseudoephedrine, tetrahydrozoline, tramazoline, tuaminoheptane, tymazoline, vasopressin, xylometazoline and mixtures thereof.

5. The device of Claim 4, wherein said vasoconstrictor comprises in the range of 0.1 – 10.0 wt. % of said coating.

6. The device of Claim 1, wherein said coating comprises a dry coating, said dry coating comprising an aqueous solution prior to drying.

7. A device for transdermally delivering a biologically active agent and a vasoconstrictor, comprising:

a member having a plurality of stratum corneum-piercing microprotrusions; and

a coating disposed on said member, said coating including a biologically effective amount of a biologically active agent selected from the group consisting of a conventional

vaccine, recombinant protein vaccine, DNA vaccine, therapeutic cancer vaccine and mixtures thereof, and a biologically effective amount of a vasoconstrictor selected from the group consisting of amidephrine, cafaminol, cyclopentamine, deoxyepinephrine, epinephrine, felypressin, indanazoline, metizoline, midodrine, naphazoline, nordefrin, octodrine, orinpressin, oxymethazoline, phenylephrine, phenylethanolamine, phenylpropanolamine, propylhexedrine, pseudoephedrine, tetrahydrozoline, tramazoline, tuaminoheptane, tymazoline, vasopressin, xylometazoline and mixtures thereof.

8. A device for transdermally delivering a biologically active agent and a vasoconstrictor, comprising:

a member having a plurality of stratum corneum-piercing microprotrusions; and

a coating disposed on said member, said coating including a biologically effective amount of a biologically active agent selected from the group consisting of ACTH (1-24), calcitonin, desmopressin, LHRH, LHRH analogs, goserelin, leuprolide, parathyroid hormone (PTH), vasopressin, deamino [Val4, D-Arg8] arginine vasopressin, buserlin, triptorelin, interferon alpha, interferon beta, interferon gamma, FSH, EPO, GM-CSF, G-CSF, IL-10, glucagon, growth hormone releasing factor (GRF) and analogs thereof, and mixtures thereof, and a biologically effective amount of a vasoconstrictor selected from the group consisting of amidephrine, cafaminol, cyclopentamine, deoxyepinephrine, epinephrine, felypressin, indanazoline, metizoline, midodrine, naphazoline, nordefrin, octodrine, orinpressin, oxymethazoline, phenylephrine, phenylethanolamine, phenylpropanolamine, propylhexedrine, pseudoephedrine, tetrahydrozoline, tramazoline, tuaminoheptane, tymazoline, vasopressin, xylometazoline and mixtures thereof.

9. A device for transdermally delivering a biologically active agent and a vasoconstrictor, comprising:

a member having a plurality of stratum corneum-piercing microprotrusions; and

a dry coating disposed on at least one of said plurality of stratum corneum-piercing microprotrusions, said coating including a biologically active agent and a vasoconstrictor.

10. The device of Claim 9, wherein said biologically active agent comprises a vaccine selected from the group consisting of conventional vaccines, recombinant protein vaccines, DNA vaccines and therapeutic cancer vaccines.

11. The device of Claim 9, wherein said biologically active agent is selected from the group consisting of ACTH (1-24), calcitonin, desmopressin, LHRH, LHRH analogs, goserelin, leuprolide, parathyroid hormone (PTH), vasopressin, deamino [Val4, D-Arg8] arginine vasopressin, buserlin, triptorelin, interferon alpha, interferon beta, interferon gamma, FSH, EPO, GM-CSF, G-CSF, IL-10, glucagon, growth hormone releasing factor (GRF) and analogs of these agents, including pharmaceutically acceptable salts thereof and mixtures thereof.

12. The device of Claim 9, wherein said vasoconstrictor is selected from the group consisting of amidephrine, cafaminol, cyclopentamine, deoxyepinephrine, epinephrine, felypressin, indanazoline, metizoline, midodrine, naphazoline, nordefrin, octodrine, orinpressin, oxymethazoline, phenylephrine, phenylethanolamine, phenylpropanolamine, propylhexedrine, pseudoephedrine, tetrahydrozoline, tramazoline, tuaminoheptane, tymazoline, vasopressin, xylometazoline and mixtures thereof.

13. The device of Claim 12, wherein said vasoconstrictor comprises in the range of 0.1 – 10.0 wt. % of said coating.

14. The device of Claim 9, wherein each of said plurality of stratum corneum-piercing microprotrusions has a length less than approximately 1000 microns.

15. The device of Claim 14, wherein each of said plurality of stratum corneum-piercing microprotrusions has a length less than approximately 500 microns.

16. The device of Claim 9, wherein each of said plurality of stratum corneum-piercing microprotrusions has a thickness in the range of approximately 5 – 50 microns.

17. The device of Claim 9, wherein said coating has a thickness less than 50 microns.

18. The device of Claim 17, wherein said coating thickness is less than 10 microns.

19. The device of Claim 9, wherein each of said plurality of stratum corneum-piercing microprotrusions includes in the range of 1 microgram to 1 milligram of said biologically active agent.

20. A device for transdermally delivering a biologically active agent and a vasoconstrictor, comprising:

a member having a plurality of stratum corneum-piercing microprotrusions, each of said microprotrusions having a length of less than 1000 microns and a thickness less than 50 microns; and

a dry coating disposed on said member, said coating including a biologically active agent and a vasoconstrictor.

21. A method of making a device for transdermally delivering a biologically active agent and a vasoconstrictor, the method comprising:

providing a member having a plurality of stratum corneum-piercing microprotrusions, said microprotrusions having a length of less than 1000 microns;

applying an aqueous solution of a biologically active agent and a vasoconstrictor onto the member; and

drying said applied aqueous solution to form a dry agent-containing coating on said member.

22. The method of Claim 21, wherein said biologically active agent comprises a vaccine selected from the group consisting of conventional vaccines, recombinant protein vaccines, DNA vaccines and therapeutic cancer vaccines.

23. The method of Claim 21, wherein said biologically active agent is selected from the group consisting of ACTH (1-24), calcitonin, desmopressin, LHRH, LHRH analogs, goserelin, leuprolide, parathyroid hormone (PTH), vasopressin, deamino [Val4, D-Arg8] arginine vasopressin, buserlin, triptorelin, interferon alpha, interferon beta, interferon gamma, FSH, EPO, GM-CSF, G-CSF, IL-10, glucagon, growth hormone releasing factor (GRF) and analogs of these agents, and mixtures thereof.

24. The method of Claim 21, wherein said vasoconstrictor is selected from the group consisting of amidephrine, cafaminol, cyclopentamine, deoxyepinephrine, epinephrine, felypressin, indanazoline, metizoline, midodrine, naphazoline, nordefrin, octodrine, orinpressin, oxymethazoline, phenylephrine, phenylethanolamine, phenylpropanolamine, propylhexedrine, pseudoephedrine, tetrahydrozoline, tramazoline, tuaminoheptane, tymazoline, vasopressin, xylometazoline and mixtures thereof.

25. The device of Claim 24, wherein said vasoconstrictor comprises in the range of 0.1 – 10.0 wt. % of said coating.

26. The method of Claim 21, wherein said coating is applied by dip coating.

27. The method of Claim 21, wherein said coating is applied by spray coating.

28. The method of Claim 21, wherein said coating is applied by pattern coating.

29. A method of making a device for transdermally delivering a biologically active agent and a vasoconstrictor, the method comprising:

providing a sheet member;

etching a microprojection array on said sheet member to form a plurality of microprojections;

bending said plurality of microprojections whereby said plurality of microprojections project from a plane of said sheet member;

coating at least a first microprojection of said plurality of microprojections with an aqueous solution containing a biological active agent and a vasoconstrictor; and

drying said applied aqueous solution to form a dry agent containing coating on said first microprojection.

30. The method of Claim 29, wherein each of said plurality of microprojections are coated with said aqueous solution.

31. The method of Claim 29, wherein each of said plurality of microprojections has a length less than 1000 microns.

32. The method of Claim 29, wherein each of said plurality of microprojections are bent at an angle of approximately 90° relative to said sheet member plane.

33. The device of Claim 29, wherein said biologically active agent comprises a vaccine selected from the group consisting of conventional vaccines, recombinant protein vaccines, DNA vaccines and therapeutic cancer vaccines.

34. The method of Claim 29, wherein said biologically active agent is selected from the group consisting of ACTH (1-24), calcitonin, desmopressin, LHRH, LHRH analogs, goserelin, leuprolide, parathyroid hormone (PTH), vasopressin, deamino [Val4, D-Arg8] arginine vasopressin, buserlin, triptorelin, interferon alpha, interferon beta, interferon gamma, FSH, EPO, GM-CSF, G-CSF, IL-10, glucagon, growth hormone releasing factor (GRF) and analogs of these agents, and mixtures thereof.

35. The method of Claim 29, wherein said vasoconstrictor is selected from the group consisting of amidephrine, cafaminol, cyclopentamine, deoxyepinephrine, epinephrine, felypressin, indanazoline, metizoline, midodrine, naphazoline, nordefrin, octodrine, orinpressin, oxymethazoline, phenylephrine, phenylethanolamine, phenylpropanolamine, propylhexedrine, pseudoephedrine, tetrahydrozoline, tramazoline, tuaminoheptane, tymazoline, vasopressin, xylometazoline and mixtures thereof.

36. The device of Claim 35, wherein said vasoconstrictor comprises in the range of 0.1 – 10.0 wt. % of said coating.

37. The method of Claim 29, wherein said coating is applied by dip coating.

38. The method of Claim 29, wherein said coating is applied by spray coating.

39. The method of Claim 29, wherein said sheet member is formed from a material selected from the group consisting of stainless steel and titanium.